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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/096,858	06/12/98	NARWANKAR	P AMAT2571.US/

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EXAMINER	
MAI, A	
ART UNIT	**PAPER NUMBER**
2814	

DATE MAILED: 04/19/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary	Application No.	Applicant(s)	
	09/096,858	NARWANKAR ET AL.	
	Examiner	Art Unit	
	Anh D. Mai	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

1)☒ Responsive to communication(s) filed on *28 January 2000* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-45* is/are pending in the application.

4a) Of the above claim(s) *33-45* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

a)☐ All b)☐ Some * c)☐ None of the CERTIFIED copies of the priority documents have been:

1.☐ received.

2.☐ received in Application No. (Series Code / Serial Number) _____ .

3.☐ received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. & 119(e).

Attachment(s)

14) ☒ Notice of References Cited (PTO-892)
15) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
16) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *8* .
17) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
18) ☐ Notice of Informal Patent Application (PTO-152)
19) ☐ Other: .

DETAILED ACTION

Specification

1. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 2, 4-7, 8-12, 14-17, 19 and 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carl et al. (U.S. Patent No. 5,468,687) in view of Slomowitz (U.S. Patent No. 4,888,088).

Carl teaches a method of annealing a dielectric layer substantially as claimed including:

forming a dielectric layer on a substrate;

generating an active atomic species; and

exposing the dielectric layer to the active atomic species. (See col. 2, ll. 29-55).

Thus, Carl is shown to teach all of the features of the claim with the exception of generating an active atomic species in a chamber that differ from the chamber holding the substrate.

Slomowitz shows an alternative way to exposing the surface of a wafer (14) with atomic species generating in a chamber that differs than the chamber holding the wafer. (See Fig. 1, col. 2, l. 55-col. 3, l. 27).

One skilled in the art, at the time of the invention, would have found it obvious to expose the dielectric formed on the substrate of Carl with the atomic species generate remotely as taught by Slomowitz to protect the devices formed on the wafer. (See col. 1, ll. 9-27).

With respect to claims 2 and 9, the active atomic species of Carl comprises oxygen.

With respect to claims 4, 10 and 21, the dielectric of Carl comprises a metal-oxide.

With respect to claims 5, 11, and 22, the dielectric of Carl comprises a transition metal dielectric.

With respect to claims 6, 12 and 23, the dielectric layer of Carl comprises tantalum pentaoxide.

With respect to claims 7 and 15, the heating temperature of the dielectric layer of Carl is at the claimed range.

With respect to claims 8 and 14, the present claims and claim 1 are similar in scope.

With respect to claim 16, the second chamber of Slomowitz is a microwave applicator cavity of a remote plasma generator. (See Fig. 1).

With respect to claim 17, the reactive oxygen atoms are formed by generating a plasma from O2 molecules. (See Carl, col. 2, l. 48).

With respect to claim 19, Carl, in view of Slomowitz, is shown to teach all of the features of the claim including generating a plasma from O2 molecules utilizing microwaves.

3. Claims 3, 13, 18 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carl '687 and Slomowitz '088 as applied to claims 1, 8 and 14 above, and further in view of Hasegawa (U.S. Patent No. 5,677,015).

Carl and Slomowitz are shown to teach all of the features of the claim with the exception of using reactive nitrogen atoms generating from N2O, and including dielectric layer comprises silicon-oxide.

Hasegawa shows using N2O molecules to generate reactive nitrogen atoms. (claims 18 and 3) (See Fig. 1, col. 3, l. 50-col. 4, l. 13 and example 6).

One skilled in the art, at the time of the invention, would have found it obvious to use N2O molecules in generating the reactive oxygen atoms of Carl as taught by

Hasegawa to perform treatment on the dielectric layer because nitrogen atoms react with carbon atoms, thus removing carbon atoms from the dielectric layer.

Hasegawa, further, shows forming dielectric layer comprises silicon-oxide (18). (claim 13 and 20).

One skilled in the art, at the time of the invention, would have found it obvious to form the dielectric layer (18) over the substrate of Carl as taught by Hasegawa isolate the capacitor from the underlying devices.

4. Claims 1-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hasegawa '015 in view of Slomowitz '088.

Hasegawa teaches a method of annealing a dielectric layer substantially as claimed including:

forming a dielectric layer (22) on a substrate (10);

generating an active atomic species; and

exposing the dielectric layer to the active atomic species. (See Fig. 1, col. 3, l. 50-col. 5, l. 25).

Thus, Hasegawa is shown to teach all of the features of the claim with the exception of generating an active atomic species in a chamber that differ from the chamber holding the substrate.

Slomowitz shows an alternative way to exposing the surface of a wafer (14) with atomic species generating in a chamber that differs than the chamber holding the wafer. (See Fig. 1, col. 2, l. 55-col. 3, l. 27).

One skilled in the art, at the time of the invention, would have found it obvious to exposing the dielectric formed on the substrate of Hasegawa with the atomic species generate remotely as taught by Slomowitz to protect the devices formed on the wafer. (See Slomowitz col. 1, ll. 9-27).

With respect to claims 2 and 9, the active atomic species of Hasegawa comprises oxygen.

With respect to claim 3, the active atomic species of Hasegawa comprises reactive nitrogen atoms.

With respect to claims 4, 10 and 21, the dielectric layer (22) of Hasegawa comprises a metal-oxide.

With respect to claims 5, 11, and 22, the dielectric layer (22) of Hasegawa comprises a transition metal dielectric.

With respect to claims 6, 12 and 23, the dielectric layer (22) of Hasegawa comprises tantalum pentaoxide.

With respect to claims 7 and 15, the heating temperature of the dielectric layer of Carl is at the claimed temperature or higher, however, no criticality is indicated.

With respect to claims 8 and 14, these claims and claim 1 are similar in scope.

With respect to claim 13, the dielectric layer of Hasegawa comprises silicon-oxide (18).

With respect to claim 16, the second chamber of Slomowitz is a microwave applicator cavity of a remote plasma generator. (See Fig. 1).

With respect to claim 17, the reactive oxygen atoms are formed by generating a plasma from O2 molecules. (See Carl, col. 2, l. 48).

With respect to claim 18, the reactive oxygen atoms of Hasegawa are formed by generating a plasma from N2O molecules.

With respect to claim 19, Hasegawa, in view of Slomowitz, is shown to teach all of the features of the claim including generating a plasma from O2 molecules utilizing microwaves.

With respect to claim 20, the deposited oxide (18) of Hasegawa is a silicon – oxide.

5. Claims 24-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hasegawa (5,677,015) in view of Slomowitz '088.

Hasegawa teaches a method of forming a capacitor substantially as claimed including:

forming a bottom electrode (20);

depositing a transition metal dielectric (22) on the bottom electrode in a deposition chamber;

generating reactive oxygen atoms by forming a plasma from an oxygen-containing gas in a chamber;

annealing the transition metal dielectric (22) by exposing the transition metal dielectric to the reactive oxygen atoms; and

forming a top electrode (24) on the reactive oxygen atoms exposed transition metal dielectric. (See example 4, col. 6, l. 31-col. 7, l. 17 and example 6, col. 8, l. 1-col. 9, l. 13).

Thus, Hasegawa is shown to teach all of the features of the claim with the exception of generating a reactive oxygen atoms in a microwave applicator cavity in a remote plasma generating chamber.

Slomowitz shows an alternative way to generate a reactive oxygen atoms using a microwave applicator cavity in a remote plasma generating chamber. (See Fig. 1, col. 2, l. 55-col. 3, l. 27).

One skilled in the art, at the time of the invention, would have found it obvious to exposing the dielectric formed on the substrate of Hasegawa with the reactive oxygen atoms generated remotely as taught by Slomowitz to protect the devices formed on the wafer. (See Slomowitz col. 1, ll. 9-27).

With respect to claims 25-27 and 29, the transition metal dielectric of Hasegawa is tantalum pentaoxide, deposited by CVD utilizing a source gas comprising TAETO, TAT-DMAE, O2 and N2O.

With respect to claim 28, the transition metal dielectric layer (22) of Hasegawa is deposited at a temperature as claimed.

With respect to claim 30, the transition metal dielectric film of Hasegawa is annealed in the deposition chamber.

With respect to claim 31, the heating temperature of the transition metal dielectric layer of Hasegawa is at the higher end of the claimed range, however, no criticality has been established.

6. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hasegawa, in view of Slomowitz, as applied to claim 24 above, and further in view of Nishiki et al. (U.S. Patent No. 5,989,782).

Hasegawa, in view of Slomowitz, is shown to teach all of the features of the claim with the exception of anneal the transition metal dielectric in a chamber other than the deposition chamber.

Nishiki teaches using a multi-chamber processing tool wherein annealing is conducted in a chamber other than the film deposition chamber. (See col. 6, ll. 3-7).

One skilled in the art, at the time of the invention, would have found it obvious to anneal the transition metal dielectric (22) of Hasegawa in a chamber other than the deposition chamber as taught by Nishiki to avoid reacting the transition metal dielectric (22) with the ambient in the deposition chamber, specially carbon atoms, thus deterioration of the transition metal dielectric is eliminated.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M.

Anh D. Mai
April 14, 2000

Olik Chaudhuri
Supervisory Patent Examiner
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